Optimizing a Façade from an Energy Perspective

The mechanical engineer plays a necessary role in the design of a high-performing façade. Ideally, either the mechanical engineer or lighting designer should lead the iterative process necessary to producing an energy efficient design.

Selecting Essential Facades to Optimize

If you are already at the stage where you are figuring out details of the façade design, you should be at a point where you have some floor plans, sections, and elevations (or hopefully a basic REVIT model!) for the building. If you are not yet at this stage, figuring out façade details may not be the best use of your time right now(perhaps you should help the architect with massing strategies if that is the case). Use your preliminary knowledge of the building to select the key facades to optimize.

- South-facing facades are critical from an energy perspective due to the solar heat gain the façade will receive. All of these facades should be analyzed.
- Select West/East-facing facades could also be worth optimizing for morning and afternoon sun.
- North-facing facades should be left more for the lighting designer, as long as the curtain-wall glass has an acceptable U-value. The lighting designer has more to gain with the north facades due to the great daylighting potential those have, and the solar gain on those facades are almost negligible.

For the rest of this Wiki, a south-facing façade will be assumed.

Use of Energy Modeling

Energy modeling software like Trane TRACE 700 and Ecotect can be great tools to use during the iterative façade design process.

Optimizing Solar Shading Devices in Ecotect

Solar shading devices are analyzed most easily in Ecotect. Ecotect is a great program to use especially if your design team has a decent REVIT model. If only solar shading is to be used in this program, follow these instructions:

- Add your solar shading devices into your revit model. Suggestions could include roof overhangs, louver systems, or shading devices on the mullions of the façade (both vertical and horizontal).
- From Revit, export your model as a gbXML file. If only solar shading devices are to be analyzed, nothing else needs to be done. If you are looking to use other energy modeling functions in Ecotect, a more complex export process needs to be done. See other BIM Wikis for that information.
- In Ecotect, run a solar study. In the outcome of this study, you can analyze the shading devices from both a visual and numerical perspective. Fig. 1 shows an example of a solar study done in Ecotect.

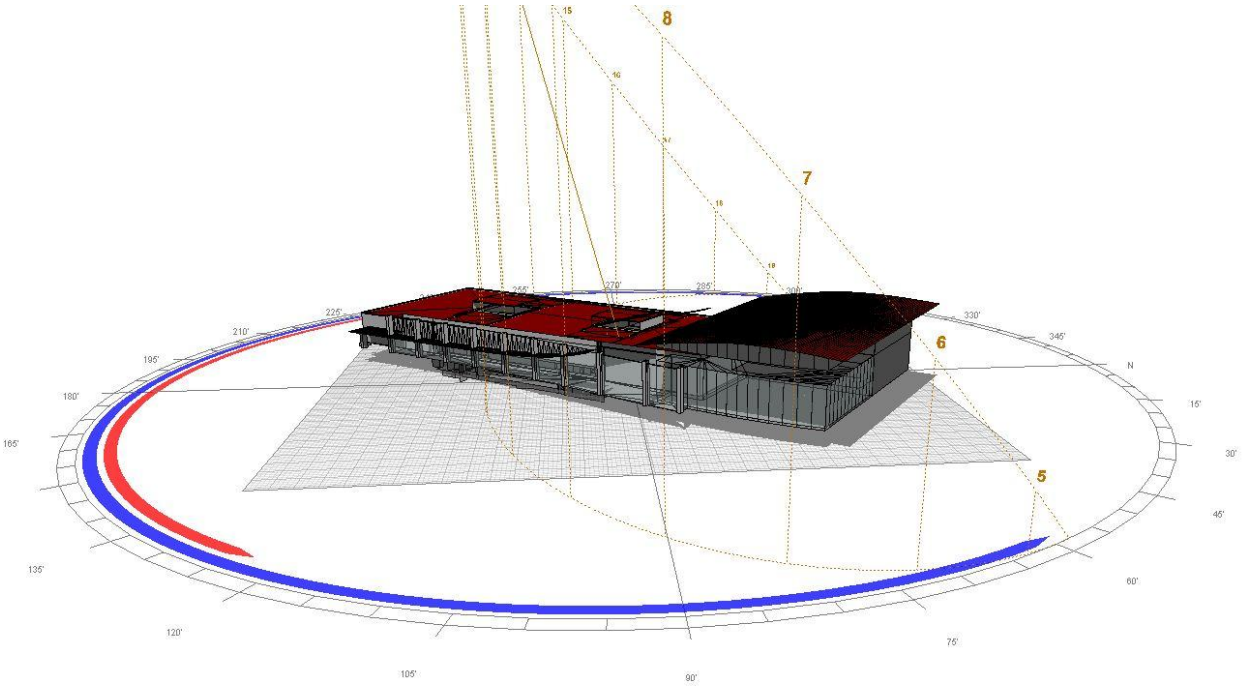

Fig. 1 – Solar study performed in Ecotect.

Optimizing U-values and Solar Heat Gain Coefficients in Trane TRACE

The U-value and shading coefficients of the glass have a large impact on the performance of the façade. Therefore, the type of glass the team chooses for the façade is very important. An iterative process should take place between the mechanical engineer and the lighting designer to work out these details. Use these ground rules to optimize the façade details:

- Solar Heat Gain Coefficient should be minimized on south-facing façade. As the mechanical engineer, push for the lowest possible SHGC in the glass details. However, usually the low SHGC glass produces low visible transmittance, so the lighting designer will probably push for a slightly higher SHGC than the mechanical engineer, so a balance can be achieved.
- U-value of the glass should also be minimized. Lower U-values produce a higher-performing façade. See ASHRAE 90.1 standards for the minimum U-value for the façade, but this is an easy way to achieve results beyond the 90.1 standard models. Lower U-value glass is typically more expensive as it starts dipping into triple glazing and multiple pane territories, so the construction manager will probably limit your glass selection on a cost basis.

Trane TRACE is an easy way to see the effects of different glass types relative to one another. After you have modeled your space in TRACE:

- Go to the "Create Rooms" tab
- Select "Walls" on the bottom
- Here, you can change the details of the glass façade. U-factor and Sh. Coef. are both present on this screen. Figure 2 Shows a print-screen of this part of the TRACE modeling software
- After you make some changes to these values, run your analysis. Perform multiple iterations to see the effect of these values on the performance of the space inside the façade.

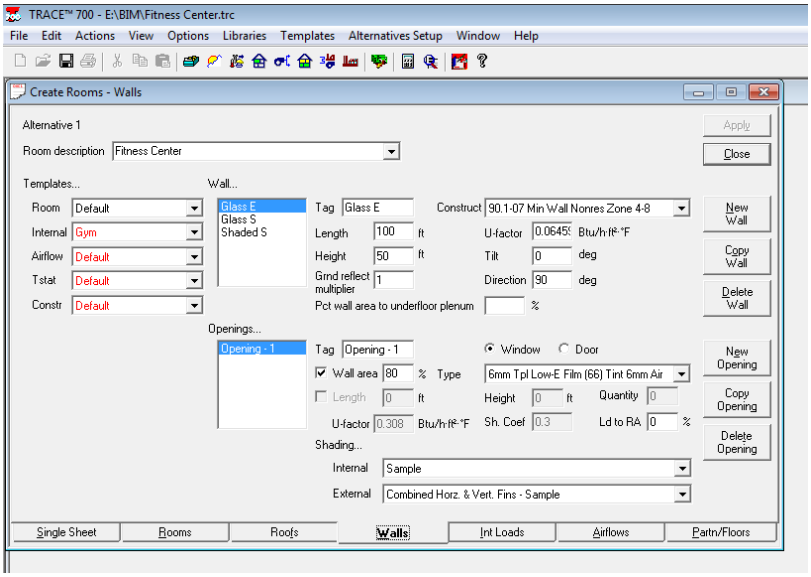

Figure 2: Trane TRACE modeling software